



Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Plant Industry Sub-branch

UNITED STATES
DEPARTMENT OF AGRICULTURE
LIBRARY



1

BOOK NUMBER

Ag84D

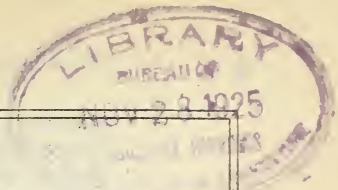
v. 326-350

1924-1925

531127

epo 8-7871

USDA, National Agricultural Library
NAL Bldg
10301 Baltimore Blvd
Beltsville, MD 20705-2351



UNITED STATES DEPARTMENT OF AGRICULTURE

DEPARTMENT CIRCULAR 331

Washington, D. C.

November, 1925

STANDARD SPECIFICATIONS FOR CORRUGATED METAL PIPE CULVERTS

Adopted by the
AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS

And Approved by the
SECRETARY OF AGRICULTURE
For Use In Connection With Federal-aid Road Work

MATERIALS

Corrugated metal pipe culverts shall be fabricated from corrugated galvanized sheets, the base metal of which shall be made by the open-hearth process. The base metal in the finished sheets shall conform to the following chemical requirements:

The total amount of carbon, phosphorus, sulphur, manganese, and silicon shall not exceed 0.7 per cent. If the total of these five elements equals or exceeds 0.20 per cent, the metal shall contain not less than 0.17 per cent of copper and not more than 0.06 per cent of sulphur. If the total of these five elements is less than 0.20 per cent, the presence of copper is optional and sulphur shall not exceed 0.04 per cent.

All rivets shall be of the same material as the base metal specified for the corrugated sheets. They shall be thoroughly galvanized or sherardized.

The average weight per square foot of the culvert sheets, as determined by weighing in lots not exceeding 6,000 pounds, shall not vary from the theoretical weight by more than five per cent either way for each lot of one gauge and size.

Weight of spelter coating.—The base-metal sheets shall be uniformly galvanized on both sides by the hot process. A uniform coating of prime western spelter shall be applied at the rate of not less than 2 ounces per square foot of metal. If the average spelter coating as determined from samples shows less than 2 ounces of

spelter per square foot of metal, or if any one sample shows less than 1.8 ounces of spelter per square foot of metal, the shipment shall be rejected. Sheets having blister spots, holes, or other imperfections in the galvanizing after corrugating shall be rejected.

Tests for spelter coating.—The tests for weight of spelter coating shall be made as described in United States Department of Agriculture Department Bulletin 1216, Tentative Standard Methods of Sampling and Testing Highway Materials, adopted by the American Association of State Highway Officials.

5. Accepted Brands of Metal. No metal will be accepted under these specifications and no bids will be considered for the materials above described until after the sheet manufacturer's certified analysis and manufacturer's guarantee have been passed upon by the engineer and accepted.

Misbranding or other misrepresentation, and nonuniformity of product, will each be considered a sufficient reason to discontinue the acceptance of any brand under these specifications, and notice sent to the sheet manufacturer of the discontinuance of acceptance of any brand will be considered to be notice to any culvert companies which handle that particular brand.

The brand of metal to be furnished shall be specified in the bid.

6. Sheet Manufacturer's Certified Analysis. The manufacturer of each brand shall file with the engineer a certificate setting forth the name or brand of metal to be furnished and a typical analysis showing the percentage of each of the five above-mentioned chemical elements. The certificate shall be sworn to for the manufacturing company by a person having legal authority to bind the company.

7. Sheet Manufacturer's Guarantee. The manufacturer of the sheets shall submit with the certified analysis a guarantee providing that all metal furnished shall conform to the certified analysis filed, shall bear a suitable identification brand or mark, and shall be replaced without cost to the purchaser when not in conformity with the specified analysis, gauge, or spelter coating; and the guarantee shall be so worded as to remain in effect so long as the manufacturer continues to furnish material.

8. Identification. No culverts will be accepted unless the metal is identified by a stamp on each section showing—

First. Name of sheet manufacturer.

Second. Name of brand.

Third. The gauge.

The identification brands shall be placed on the sheets by the manufacturers of the sheets in such a way that when rolled into culverts such identification shall appear on the outside of each section of each pipe. Pipe having any sections not so stamped shall be promptly rejected.

9. Laboratory Tests. When not otherwise provided, laboratory tests shall be made in accordance with the methods of the American Society for Testing Materials and by the chemist or in-

spection bureau designated or approved by the engineer. No considerable shipment of metal shall be rejected until after a check analysis has been made. In any case in which the analysis of the base metal is in dispute, the question may be referred to an umpire chemist, mutually satisfactory to both parties, whose decision shall be considered final.

If the engineer so elects he may have the material inspected at the rolling mill or the culverts inspected in the shop where they are fabricated. He may require from the mill that a chemical analysis be made of any heat. The inspection both at the mill and at the shop shall be made under the direction of the engineer. The engineer, or his representative, shall have free access to the mill or shop for inspection purposes, and every facility shall be extended to him for this purpose. Any material or pipe included in any shipment which has been rejected at the mill or shop will be considered sufficient cause for the rejection of the entire shipment.

10. Mill and
Factory In-
spection.

CONSTRUCTION

Culverts furnished under these specifications shall be of the full-circle, riveted type, with lap-joint construction.

11. Shape.

For farm-entrance crossings the minimum diameter of pipe shall be 12 inches. For roadway culverts the minimum diameter permitted shall be 15 inches. The maximum diameter permitted shall be 36 inches.

12. Maxi-
mum and Min-
imum Sizes
Admitted.

The lengths of sheets, widths of laps, gauge of the uncoated metal (United States standard gauge), and theoretical weight per linear foot of the finished culverts, shall be as specified in the following table. The dimensions given for diameter of pipe are nominal. The average weight per linear foot of a finished culvert, exclusive of end finish, shall not underrun the theoretical weight specified by more than 5 per cent.

13. Dimen-
sions and
Weights.

Nominal diam- eter	Length of sheet before forming	Width of lap	Minimum gauge U. S. standard	Theoretical weight per linear foot of finished culvert exclusive of end finish
<i>Inches</i>	<i>Inches</i>	<i>Inches</i>		<i>Pounds</i>
12	40	2.0	16	10.5
15	50	2.0	16	13.1
18	60	2.5	16	15.7
21	70	2.5	14	22.5
24	80	3.0	14	25.8
30	100	3.5	14	32.2
36	120	3.5	12	53.3

The length of culvert specified shall be the net length of the finished culvert which does not include any material used to procure an end finish on the pipe. If the average deficiency in length of any shipment of pipe is greater than 1 per cent, the shipment shall be rejected.

14. N e t
Length of Cul-
vert Pipe.

15. Length of Sections. All pipe shall be furnished in the lengths ordered, except that pipe for culverts 26 feet or more in length may be furnished in sections not less than 12 feet in length, provided all necessary field couplings are furnished free of charge.

For small shipments involving less than carload lots, the above requirements may be modified by written authorization from the engineer.

16. Corrugations. Corrugations shall be not less than $2\frac{1}{4}$ nor more than $2\frac{3}{4}$ inches center to center. The corrugations shall have a depth of not less than $\frac{1}{2}$ inch.

17. Rivets and Riveting. Rivets shall have the following dimensions:

No. 16 gauge material (two thicknesses of sheets), $\frac{5}{8}$ by $\frac{1}{2}$ inch.

No. 14 gauge material (two thicknesses of sheets), $\frac{5}{8}$ by $\frac{5}{8}$ inch.

No. 14 gauge material (three thicknesses of sheets), $\frac{5}{8}$ by $\frac{3}{4}$ inch.

No. 12 gauge material (two thicknesses of sheets), $\frac{3}{8}$ by $\frac{3}{4}$ inch.

No. 12 gauge material (three thicknesses of sheets), $\frac{3}{8}$ by $\frac{7}{8}$ inch.

All rivets shall be driven cold in such a manner that the plates shall be drawn tightly together throughout the entire lap. No rivet shall be closer than twice its diameter from the edge of the metal. All rivets shall have neat, workmanlike, and full hemispherical heads or heads of a form acceptable to the engineer, shall be driven without bending, and shall completely fill the hole. Longitudinal seams shall be riveted with one rivet in each full corrugation. The longitudinal seams of 30 and 36 inch pipe shall be double riveted. Circumferential, shop-riveted seams shall have a maximum rivet spacing of 6 inches, and shall lap at least one full corrugation, except that six rivets will be sufficient in 12-inch pipe.

18. End Finish. The inlet and outlet of all culverts, if for use without head walls, shall be reinforced in a manner approved by the engineer.

If a band is used, it shall be riveted around the end of the culvert with rivets at intervals of 10 inches or less. This band shall be of galvanized metal equivalent in cross section to $\frac{3}{8}$ inch by 1 inch for 16-gauge metal; and $\frac{3}{8}$ inch by $1\frac{1}{2}$ inches for 14-gauge and 12-gauge metal.

The end finish or end reinforcement shall be specified in the proposal.

19. Coupling Bands.

Field joints shall be made with bands of the same material as the culvert, and shall be not less than $7\frac{1}{2}$ inches wide, so constructed as to lap an equal portion of each of the culvert sections to be connected. Such bands shall be connected at the ends by angles having minimum dimensions of $1\frac{1}{2}$ by $1\frac{1}{2}$ by $\frac{1}{8}$ inch and of length equal to full width of band or by other approved connections of

suitable strength. Each connection shall be fastened by at least two bolts not less than $\frac{1}{2}$ inch in diameter. All such connections shall be made of galvanized metal of the same quality as the base metal in the culvert.

It is the essence of these specifications that in addition to compliance with the details of construction the completed pipe shall show careful, finished workmanship in all particulars. 20. Work-
manship.

Culvert pipe on which the spelter coating has been bruised or broken either in the shop or in shipping, or which shows defective workmanship, shall be rejected.

This requirement applies not only to the individual pipe, but to the shipment on any contract as a whole. Among others, the following defects are specified as constituting poor workmanship and the presence of any or all of them in any individual culvert pipe or in general in any shipment shall constitute sufficient cause for rejection:

- (1) Uneven laps.
- (2) Elliptical shaping.
- (3) Variation from a straight center line.
- (4) Ragged or diagonal sheared edges.
- (5) Loose, unevenly lined or spaced rivets.
- (6) Poorly formed rivet heads.
- (7) Unfinished ends.
- (8) Illegible brand.
- (9) Lack of rigidity.
- (10) Bruised, scaled, or broken spelter coating.
- (11) Dents or bends in the metal itself.

The field inspection shall be made by the engineer who shall be furnished by the seller with an itemized statement of the sizes and lengths of culvert pipe in each shipment. This inspection shall include an examination of the culvert pipe for deficiencies in length of sheets used, nominal specified diameter, net length of finished culvert pipe, and any evidence of poor workmanship as outlined above. The inspection may include the taking of samples for chemical analysis and determination of weight of spelter coating. 21. Field
Inspection
and Accept-
ance of Pipe.

The inspection shall be made promptly upon the arrival of the material, and the purchaser shall be responsible for any demurrage which accrues on account of neglect to make proper inspection after he has received 48 hours' notice of the arrival of the shipment.

The pipe making up the shipment shall fully meet the requirements of these specifications, and if 50 per cent of the pipe in any shipment fails to meet these requirements the entire shipment may be rejected.

Sampling.—When samples are taken for chemical analysis and determination of weight of spelter coating, at least one sample from which a specimen $2\frac{1}{4}$ inches square may be prepared shall be selected from each 10 culverts of a shipment, and not less than three samples shall represent any one shipment.

22. *Laying
Pipe.*

Culverts under the highway shall be placed so that the distance from finished grade of roadway to the top of pipe shall be not less than one-half the diameter of the pipe with a minimum of 1 foot.

A trench shall be excavated to the depth and grade established by the engineer. The bottom of the trench shall be shaped to conform to the bottom of the pipe and to afford a firm and uniform bearing throughout the entire length of the culvert. If, in the opinion of the engineer, the material in the bottom of the excavation is of such a character as to cause unequal settlement along the length of the culvert, the trench shall be dug below the grade given to such a depth as ordered and backfilled with gravel or other suitable material and thoroughly tamped or otherwise compacted to insure an unyielding foundation. Where the trench is in solid rock or other hard material, it shall be excavated to a depth of at least 4 inches below the grade established for the bottom of the pipe, and this additional excavation shall be backfilled with suitable material in such manner as to insure a uniform bearing for the entire length of the culvert.

The pipe shall be laid in the trench with the separate sections firmly joined together and with outside laps of circumferential joints pointing up stream and with longitudinal laps on the sides. Any metal in joints which is not thoroughly protected by galvanizing shall be coated with a suitable asphaltum paint.

Selected backfilling material, free from stones, frozen lumps, etc., shall be placed under and around the pipe and thoroughly tamped or otherwise compacted in place. The trench shall be completely filled and the pipe covered to a depth of at least 1 foot with hand-placed and properly compacted materials before the construction of embankment over the culvert shall proceed in the usual manner.

23. *Measurement and
Payment.*

Corrugated metal pipe culverts shall be paid for at the contract unit price per linear foot of pipe.

When the pipe is purchased f. o. b. a specified railroad station, the unit contract price shall include delivery at that station, free of all charges, and ready for unloading and delivery to the work.

When the contract provides for the installation of the culverts complete in place, the contract unit price per linear foot shall include the excavation and backfilling of the trench and all labor and materials incidental thereto, but shall not include payment for concrete or masonry headwalls.

